TD

Distr.
GENERAL

TD/B/C.4/AC.11/2
17 July 1991

United Nations Conference on Trade and Development

Original: ENGLISH

TRADE AND DEVELOPMENT BOARD
Committee on Shipping
Group of Experts on Multimodal Transport
Geneva, 9 March 1992
Item 2 of the provisional agenda

BLOCK TRAIN SERVICES IN MULTIMODAL TRANSPORT

Report by the UNCTAD secretariat

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GE. 91-51247

Introduction

(i). The Committee on Shipping at its fourteenth session (21 - 29 June 1990) adopted resolution 67 (XIV) "Multimodal transport including work programme". In this resolution the Committee recognized the need to monitor developments in the fields of multimodal transport and containerization, owing to the rapid pace of structural and technological changes in this area, and the importance of these developments for international shipping. The Committee requested the Secretary-General of UNCTAD to convene a group of experts to discuss developments in multimodal transport and containerization wherever there is a sea link, to take stock of the principal problems that are experienced by users and providers of multimodal and/or container transport operations and to suggest elements of a future programme of work for the Committee in the field of multimodal transport and containerization.

(ii). In order to facilitate the work of the group of experts, the Committee requested the UNCTAD secretariat to make available to the group a series of studies on different aspects of multimodal transport, *inter alia* a study on block train services in multimodal transport wherever there is a sea link (cf. para. 3 (f) of resolution 67 (XIV).

(iii). The present report has been prepared by the secretariat in response to this request. The report is based on data received by the secretariat from different container block train operators in response to its questionnaire, as well as on information collected from various sources during desk research.

(iv). The subject of container transportation by rail has previously been treated by the UNCTAD secretariat in the report "Guidelines on the introduction of containerization and multimodal transport and on the modernization and improvement of the infrastructure of developing countries" (TD/B/C.4/238/Rev.1). Details concerning the requirements and adaptation of the infrastructure, rolling stock and terminals for containerization can be found in that report. Block train services are also dealt with in the secretariat's report "Developments in multimodal transport" (TD/B/C.4/328).

(v). The present report is divided into three chapters. Chapter I sets out the general features of container block train operations, including an outline of the advantages and problems of this concept and the introduction of the new technology. It considers some identified solutions and prospective methods to solve problems that are likely to occur in developing countries. This chapter also covers the multimodal aspects of container block train operations and the impact of the introduction of this system on the competition between ports.

(vi). Chapter II considers various land-bridge services in developed countries, while chapter III contains a summary of the experience with container block train operations in multimodal transport services in some developed countries and developing countries where block train services have already been introduced.

Summary and conclusions

1. With the introduction of containerization the need for effective and efficient multimodal transport systems everywhere soon became evident. Container block trains represent a logical commercial response from railways to the new requirements of the transport industry. Railways have used block trains for decades for the transport of bulk cargoes, but are now applying this concept to the transport of containers using modern organizational and planning methods together with new technology.

2. Improved turn-around of rolling stock, simpler operational organization, and savings on marshalling and shunting of wagons are some of the main advantages of the block train concept. Using block trains, railways may be able to exploit their inherent advantages of reliability, regularity of services and independence from certain regulatory restrictions applied to other modes of transport (e.g. interdiction to operate at night). Environmental considerations and energy efficiency are further assets that make railways an attractive solution to transport-development issues.

3. In order to introduce efficient block train services, a number of requirements must, however, be met. Both operational and infrastructural impediments must be overcome. Operationally, adherence to fixed schedules is a requirement. Suitable rolling stock, such as purpose-built container wagons, may be of the low-bed (well-wagon) type, and the necessary handling equipment must be in place. Special routes may have to be designated, in order to allow single-stack high-cube containers (i.e. containers with a height of over 8'06") to be carried. It may also be necessary to strengthen bridges, enlarge loading gauges, raise electric wires and so on before it will be possible to operate container block trains.

4. Measures for the upgrading of technical conditions permitting scheduled, regular movement of container block trains must go hand-in-hand with appropriate organizational arrangements reached in consultation with the users. It may, for example, be necessary to reach certain agreements which determine the sharing of responsibilities between the railway and its customers.

5. In the case of international services, various legal and administrative aspects must be considered in order to eliminate unnecessary border delays which can reduce the advantages of container block train services. Reduction in the number and duration of controls of goods in transit, simplification of Customs procedures and transfer of these procedures to places of origin and destination of container block trains should be the objectives of intergovernmental agreements between countries considering the establishment of container block train services. It is recommended that consideration be given to adherence to a corresponding international convention in this area, such as the International Convention on the Harmonization of Frontier Controls of Goods (1982).

6. Introduction of container block trains may have considerable influence on competition between ports in a region. Since containers may be brought to an inland point by different routes, the port having the best connections to the hinterland is most likely to be chosen as an interface point between land and ocean transport modes. It is recommended that for a port to improve its competitive position within a range of ports, it should actively promote the development of its transport connections with its hinterland. This may be done through the introduction of block train services and container transfer facilities. It might be possible for a port to do so by sharing the necessary investments with railways.

7. European railways operate both national and international block train services. But at present there is no possibility for the operation of double-stack container trains because of the limited infrastructure clearances. Moreover, in general only containers of up to 8 foot 6 inches high can be moved on the European railway network, and special arrangements, such as the introduction of low-floor wagons and the establishment of specific routes, are required for the carriage of high-cube containers.

8. In some cases, national railways have established subsidiaries to operate container block trains. This has allowed, for example, the German railway organization ***Transfracht*** to set up a grid tariff system making possible flexible pricing of container transportation based on the prevailing competitive situation.

9. At the inter-European level most international container block train operations are provided

by the International Company for Transport by Containers (Intercontainer), which has an extensive and constantly developing network of Trans-Europe-Container-Expresses connecting important European ports and major industrial centres.

10. In the countries of Eastern and Central Europe, fixed routes with fixed scheduled operation of container block trains have long been established. Some of these are connected with container ship sailings/arrivals or can be viewed as an extention of the Trans-Siberian container land-bridge. These countries have a sufficiently developed infrastructure and the potential to meet growth in the volume of rail container traffic that the development of economic reforms and the possible increase in East-West trade may bring about.

11. The economic advantages of double-stack container trains are obvious. Increased container capacity and the correspondingly reduced tare weight and capital costs of the equipment per payload, together with modern operational methods, ensuring a higher fuel efficiency, lower labour requirements and other operational savings, make double-stack container trains an attractive innovation. These savings are estimated at 40 per cent in the United States in relation to single-stack container block trains. Another advantage is the smoother running obtained with the articulated wagon design and, consequently, less damage to cargo. First used successfully in the United States, double-stack trains have since proliferated in transcontinental land-bridge services in both the United States and Canada, then more recently in north - south services to Mexico, and finally in Australia. In the United States the double-stack train developments were fuelled by the maritime container trade. However, these rail services have also attracted a relatively large proportion of the United States domestic containerizable cargoes. Domestic containers are frequently mixed with international containers on the same train. To deal with financial problems connected with the introduction of double-stack container train operation, the leasing of rail wagons is spreading fast in the United States. This arrangement enables the capital costs to be paid out of operating revenues.

12. Infrastructure requirements for the operation of double-stack trains are very stringent since the top of the second tier of containers on a double-stack wagon is more than 6 metres over the rail head. This makes the introduction of double-stack train services considerably more difficult than that of single-stack block trains. Furthermore, according to experience in the United States, double-stack train services are not viable for distances of less than 1,200 km. It is quite possible that double-stack train services may be economically viable in developing countries over shorter distances, but it would seem that detailed economic studies will be required on each potential route. Certain additional problems, such as necessity of improvements to terminal facilities (more space to handle the increased number of containers, new handling equipment) and specialized rolling stock must be taken into account in considering the introduction of double-stack services.

13. Container block trains represent an important element in multimodal transport service. Examples in chapter II below show that an efficient, fast and reliable transcontinental landbridge service providing guaranteed transit times and co-ordinated with ocean carriers' schedules is attractive to shippers and may enhance the revenue-earning potential of a railway, while at the same time the lack of such reliability may discourage potential customers from using railbridge services.

14. In Australia, where the state capitals are at the same time the main ports, an extensive network of routes assigned to container block train has been developed by different railway administrations. The volume and distances as well as the absence of physical restrictions have permitted the introduction of double-stack trains. The planned creation of a single body responsible for transportation by rail will stimulate further promotion of container block train operations through the elimination of differences in rules and regulations imposed by different state railway administrations.

15. Among developing countries the most noticeable accomplishments in the field of container block train operations can be found in India, where in the main corridors, almost all containers are moved by scheduled special-purpose trains. A significant increase in container traffic by rail has been registered in Pakistan, Malaysia and in Thailand where the volume of this traffic in 1990 was twice of that of 1989. The creation of inland clearance depots (ICD) or dry ports in the hinterland and the establishment of land-bridge services by foreign multimodal transport operators has contributed greatly to the introduction of container block train operations in developing countries.

16. In Africa, container block train operations appear so far to have been confined to very few countries, foremost among them Kenya. In other countries, lack of appropriate maintenance and

renewal of equipment has hampered their introduction. If the volumes of container transport justify the introduction of container block trains, it may require significant capital investments for the adaptation and upgrading of the railway infrastructure and rolling stock and the introduction of the modern methods of operation. Existing plans for upgrading transport systems in many African countries, including the establishment of ICDs, will certainly help the development of multimodal transport. This process will be further enhanced through the introduction of container block trains.

17. At the governmental level, legal, administrative and institutional arrangements must go hand-in-hand with investments in railway infrastructure and equipment. International co-operation and technical assistance will be essential in these areas. But it should be born in mind that the general conditions for the operation of container block trains in developing countries (experience of workforce, traffic density, technical conditions of railway track and structures, rolling stock, signalling installations) are different from those found in most developed countries. Dissemination of the experience of those developing countries which are already at an advanced stage in their introduction of container block trains should play a major role in technical co-operation in this field.

18. It is recommended that countries wishing to promote their transport corridors should seriously consider the advantages inherent in the operation of block train services. Not only do they draw containers away from congested highways, but the operation of rail services is also ecologically less damaging to the environment than road transport. Railways should:

(a) Establish a department for the development of container block train services;

(b) Actively discuss potential user requirements with other transport providers such as road hauliers, freight forwarders, shipping companies and other MTOs; and

(c) Consider the establishment of a competitive and flexible tariff structure.

On the basis of this, close estimates of the necessary frequency and size of trains as well as costs can be established, and plans can be made for acquiring the necessary financing of the container block train service.

19. If the regulatory set-up of a railway is ill-suited to the establishment of regular container block train services, consideration should be given to the operation of privatized services where the (private) container block train operator leases equipment from the railways and pays a fee for the use of the right of way.

20. The Group of Experts may wish to consider including in its proposals, on the future programme of work of the Committee on Shipping in the field of multimodal transport and containerization, an item on the development of container block train operations in developing countries as an essential element of the introduction of the multimodal transport concept in their transport systems. The Group may also wish to request the secretariat to carry out case studies so that the experience accumulatedin this field can be used for the promotion of this progressive transport technology by railways not already operating container block trains.

Chapter I

General Features of Container Block Train Operation

A. Some features related to railways in general and to block trains in particular

21. Increasing demands from industry and trade sectors for just-in-time (JIT) supplies and total distribution services have created a new set of requirements for the transport industry. The result is a need to reappraise and adjust the services offered. In this process, the railways are endeavouring to propose the best solution to a logistic problem, i.e. to supply production and processing industries with the right goods, in the right quantities and composition, at the right time and at the right place, so that stocks may be kept to a minimum.

22. In general advantages of a railway transport system over other modes of transport in this respect are significant. The main benefits are:

(a) Reliability, irrespective of time of day, season or weather conditions;

(b) Independance from other external restrictions (for example, interdiction to circulate at night); and

(c) Regularity of service.

23. In recent years both environmental concerns and the trend towards using the most energy- and labour-efficient modes of transportation have been drawing attention to railways which in these respects have a decisive advantage over other transport modes, in general, and road transport in particular. Rail transport provides low running resistance because of the low friction between steel wheels and steel rails. According to a study in this area[1] specific energy consumption in freight traffic (per ton per kilometre) in 1987 in the Federal Republic of Germany for railways, road transport and inland navigation, respectively, was characterized by the ratio 1 : 8.2 : 2. The same study gives data on specific noxious emissions for different modes of transport in freight traffic (table 1).

Table 1

Specific noxious emissions in freight traffic
(gram/ton/km)

Noxious emissions	Road	Rail	Inland waterways
CO (Carbon monoxide)	3 70	0 03	0 20
NO_x (Nitrogen oxide)	3 26	0 20	0 58
CH (Hydrocarbons)	1 62	0 01	0 08
Soot	0 07	0 04	0 04

Source: Rail International, Brussels, July 1990, p. 9.

24. At the same time, the main field of application of rail transport - moving heavy loads with little energy demand over long distances - necessitates costly marshalling and shunting operations to form the trains. The investments in infrastructure in marshalling yards and the costs of these operations are the main disadvantages of rail transport as compared to road transport. In addition, rail transport has a low penetration capacity in comparison with road transport because a heavy rail infrastructure is justified only in locations with a high transport demand. These are the main reasons why railways are at a disadvantage in competition with road transport as far as the transport of single wagonloads is concerned.

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1 Rail International, Brussels, July 1990, pp. 7 - 12.

B. Advantages of block trains

25. Experience has shown that the advantages of rail transport may best be realized when complete sets of loads must be moved from a single point of origin to a single point of destination by block or unit trains. Such trains run with or without intermediate stops from point-to-point on fixed schedules, avoiding intermediate tranfers of goods or marshalling and shunting operations *en route*. Two types of services may be distinguished: shuttle and block train. Shuttle service refers to a train composed of a fixed number of wagons operated between two terminals with no adjustment of train capacity following fluctuations in demand for transport. Block trains also travel between two terminals on a fixed schedule, but they are composed in accordance with the real demand for transport.

26. Block trains were introduced by railways already in the nineteenth century for the carriage of bulk cargo such as grain, coal, ore, building materials, etc. The use of block trains for the carriage of bulk commodities has since developed considerably. For example, the railways in the Federal Republic of Germanyin 1987 transported by block trains 42.7 per cent of all chargeable wagon loads and 84.4 per cent of the transportation of the major types of bulk commodities such as pit and brown coal, petroleum, mineral and building materials and iron ore.[2]

27. The necessary condition for the successful operation of block trains is a stable and adequate end-to-end traffic flow of a homogeneous commodity suited to rational mechanized loading and unloading with goods moved directly from the loading point to the unloading point in a fully loaded train. One of the main problems in the efficient operation of block trains is the cost connected with the return transportation of empty rolling stock if there is no suitable return cargo.

28. The main advantages of block trains include improved turn-around of rolling stock, simpler organization of operational activities, savings on wagon marshalling and shunting at marshalling yards, leading to a higher production yield and lower cost. Such economies may finally result in a substantial reduction of transit time and overall cost of transportation which, in turn, may enable the operator to offer attractive rates to customers.

29. The introduction of containers has permitted railways to apply the concept of block trains for the carriage of general cargo, especially in the case of transport of containers from or to sea ports and other places of accumulation of containers. Containers in this case represent a new generation of bulk cargo with harmonized dimensions permitting harmonized methods of handling and transportation between places of origin and destination. The introduction of special container wagons with simplified methods of securing the containers has contributed further to the efficiency of container block trains. Container block trains have been regarded as a logical link in the total transport chain for homogeneous cargo flow. The use of container block trains is especially pertinent when the concept of just-in-time supply is applied, taking into account the above-mentioned general advantages of rail transport.

C. Problems connected with the introduction of container block trains

30. There are various aspects to consider when establishing a new container block train service: economic, technical, administrative and legal. In the case of international services, certain aspects, such as harmonization of border controls, customs procedures etc. aimed at eliminating delays at frontiers and streamlining train movement would need to be treated at the intergovernmental level, with a view to the conclusion of bilateral agreements or adherence to an international convention in force.

Technical problems

31. In order to be able to carry containers matching the standards of the International Organization for Standardization (ISO), railways must comply with certain minimum technical requirements. The main design factors which determine technical conditions of a railway line are track

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2 Rail International, Brussels, February 1990, p. 64 - 65.

gauge, permissible axle load and speed, loading and structure gauge, permissible length and mass of trains, traffic density (frequency of movement), traffic safety installations and communications equipment. The availability and length of sidings at intermediate points and stations and at terminals are other major factors determining the feasibility of introducing container block trains.

32. The following technical aspects should be considered when studying the possibility of container block train operations:

(a) Rail transport requirements (volume of traffic) must be evaluated in terms of size (length and mass), number and frequency of block trains to be scheduled;

(b) The strength of the existing permanent way structure and capacity of bridges from the point of view of axle loads and speeds permitted as well as the volume of the necessary works to adapt track and bridge conditions to the future traffic requirements;

(c) Loading and structure gauge restrictions (including bridges and tunnels) in relation to the type of containers to be carried and to the type of rolling stock;

(d) Requirements in respect of rolling stock and locomotives (specialized flats for container transportation, their types and number required. Multi-purpose flats or low-sided wagons can also be used. The choice is determined by the volume of traffic, availability of resources and the need to reduce tare weight and to adapt the carriage of containers to the conditions of a limited loading and structure gauge when high capital investments must be made to adapt the infrastructure); and

(e) Characteristics of traffic safety and communications installations to match the requirements of the scheduled circulation of container block trains.

33. Based on wagon design and hauling capacity of locomotives on a given route, the total capacity of a block train in terms of containers can be determined. On the basis of expected volume of traffic, the frequency of movement of container block trains can be calculated. Capacity and production of handling installations at the terminals should correspond to the frequency of operation of container block trains.

34. Track gauge as such is not a decisive factor in terms of assessing the compatibility of infrastructure for the operation of container block trains; however, it should be noted that only networks with gauges of 1,000 mm and above could be considered as suitable for ISO container transport, subject also to other clearances.

35. Developing countries may face additional technical problems when introducing container block trains because of the general technical inadequacy of their railways and lack of harmonization between technical equipment. For example, when the establishment of a land-bridge for container transportation between Thailand and Malaysia was studied (Port Kelang - Butterworth - Padang Besar - Bangkok route), in addition to the above-mentioned technical problems, incompatibility of the couplings and braking systems had also to be considered. In both cases, the solution proposed was the use of either an intermediate buffer wagon or a homogeneous train composition.

36. The inadequacy of the permanent way and the corresponding impossibility to upgrade the axle load and speed of trains without important reconstruction work are other major impediments to the introduction of container block trains. A permitted axle load of 12 metric tons in combination with the use of 4-axle bogie wagons is required as a minimum. Further difficult problems are encountered when the railway networks have a different track gauge even inside one country. This situation increases transit time and adds extra costs.

37. An example of this problem is seen in rail transport between the Iberian peninsula and France. So as to ensure the passage of container block trains from a network with the standard European gauge (1,435 mm) to a one with the gauge adopted on the Iberian peninsula (1,668 mm), wagons with interchangeable axles are used. For axle changeover purposes the requisite installations have been provided at the border points of Hendaye and Cerbère. Bilateral agreements have been concluded between France and Spain regulating the operation of these installations. The axle changeover operation takes only six minutes but because of the interruption in the operating schedule, a minimum standstill time of four hours at frontiers is considered as a reference value for estimating the extra transit time involved. Added cost of 20 to 60 French francs per ton can be

considered as an indicative price.[3]

38. Another example of gauge affecting railway communication is the link between the networks of the USSR (gauge 1,520 mm) and Czechoslovakia, Poland and Romania (standard gauge network). To preclude transloading cargo at the borders, intrusive track with the gauge of 1,520 mm have been constructed leading from the Soviet frontier to stations in the countries mentioned: Reni - Galati (Romania), Cop - Kosice (Czechoslovakia), Vladimir-Volynski - Katowice (Poland).

39. These solutions are rather expensive and can be justified only by a high volume of traffic. For developing countries suitable handling equipment at the break points is a solution permitting the movement of containers from one railway system to another. Such a solution is recommended in the ESCAP report on "Standardization for the Trans-Asian Railway Specifically for Container Transport" (APRCG/87/4).

40. A determinant in the operation of container block trains is the loading gauge which defines the maximum dimensions beyond which no part of the rolling stock or cargo may protrude. More often problems in this respect arise from the height and the shape of the loading gauge. Limits in this regard occure mainly in tunnels and on bridges where adjustments would be very expensive.

41. As an example, the introduction of double-stack trains is problematic if not impossible in most countries of the world owing to insufficient clearances in tunnels, bridges and overhead catenaries. To solve the problem of insufficient loading gauge in an access tunnel in the San Francisco area of the United States, the local railway adopted the "centre gauntlet one-way track solution". This meant that in a two-track tunnel, a third track was laid down in the middle of the tunnel, where the track to ceiling clearance was the highest. This height allowed double-stack wagons to use the tunnel, albeight restricting their movements to one-way traffic only. To ensure the safety of circulation through the tunnels in question, since the existing tracks were left in operation, a special signal system was installed regulating the passage of trains.

42. Insufficient loading gauge and the important capital investments required in order to adapt the passage of block trains with certain types of containers may nesessitate the introduction of specialized rolling stock. In many European countries, high-cube containers (with their 8-foot by 9-foot-6-inch cross-section) loaded on standard container-carrying wagons exceed the loading gauge. As a result, high-cubes containers in international traffic in Europe nearly all fall into the category of out-of-gauge loads and naturally pose a safety problem. To allow the carriage of such containers, several European railways engaged in international container traffic have introduced low-floor specialized wagons called ***Multifret*** designed in France.

43. In developing countries with limited resources, a thorough examination of such variables has to be made in order to avoid unnecessary over-investments. In each specific case, a decision should be taken in the light of actual measurements, expected volume of traffic and its nature, including the dimensions of containers to be carried, cost of the necessary infrastructure adaptation and available resources. Generally, even metre-gauge railway systems allow for transport of 8-foot-6-inch-high ISO standard containers without overly expensive adjustments, but higher containers give rise to more serious problems. As a short-term solution to the problems posed by insufficient clearances, a combination of non-costly profile modifications and low-floor rolling stock may be considered.

Planning for scheduled block trains operations

44. Containerization and multimodal transport require new operational methods and co-operation between transport modes. Transport of containers by rail is one of the links in the chain of multimodal transport: railways transport containers from station to station then, as a rule, leave the rest of the carriage to the customers. In order to satisfy the principal requirements of the customers - maximum reliability and lowest possible price through rational service - there is a need, beside the pertinent infrastructure and rolling stock, for efficient planning, control and monitoring of block train operations. This requires close co-operation between the railway offering a service and its customers, as well as between the various departments of the railway itself.

45. Discussions with customers (shipping lines, NVOs, shippers, etc.) can provide the necessary

3 Rail International, Brussels, February 1989, p. 88.

input for planning of container train operations. This comprises the compiling of the timetable and composition of trains. This information includes:

(a) Types of containers and quantities expected;

(b) Anticipated frequency of movements;

(c) Type of wagons to be used; and

(d) Length and weight of trains and the times they can enter ports and terminals, etc.

46. Because of possible fluctuations in container traffic through a port or terminal, and incidents influencing the smooth flow of train circulation, certain monitoring facilities and arrangements should be provided whereby the railway administration can take corrective action to "repair" any breaks in schedules. This may involve additional costs which should be shared according to the principle of responsibility for the failure to adhere to the schedule. A special agreement in this respect may be concluded between the railway and its customers for sharing risks in the event of unavoidable changes in the timetable.

Administrative and legal problems

47. Introduction of container block trains in international service may not only pose technical problems but also those of an administrative and legal character. For example, excessively long, complicated customs procedures can negate certain advantages to be gained by the introduction of a container block train (affecting time of delivery, for example). In this case, conclusion of an agreement between the interested States on simplified and accelerated customs procedures or adherence to a corresponding international convention should be considered. Such an agreement could allow for containers to be sealed at the point of departure so that only customs seals need to be verified at borders; customs clearance then takes place at the destination.

48. Apart from customs procedures, a number of other checks such as phytosanitary inspection should be carried out by national administrations in connection with container traffic. To facilitate and accelerate this control, an international agreement could be concluded between the interested parties.

49. Under the auspices of the United Nations Economic Commission for Europe (ECE), the International Convention on the Harmonization of Frontier Controls of Goods was adopted in 1982 with entry into force in 1985. This Convention was aimed at simplifying the requirements for completing formalities while reducing the number and duration of all types of controls. This is to be achieved in particular by national and international co-ordination of procedures and of their methods of application. It applies to all goods being imported, exported or in transit. The Convention assumes that it is possible to carry out all or part of these controls elsewhere than at the frontier, provided that the procedure used contributes to the facilitation of international movement of goods. The application of these provisions is especially pertinent to container block trains in international transport, permitting the reduction of both transit time and cost of control operations. In this connection, the ECE Inland Transport Committee adopted a resolution recommending that the contracting parties to the Convention furnish to developing countries technical assistance for the implementation of the Convention.

50. Most, if not all, containers transported by block train services are carried under multimodal transport contracts. This makes the multimodal transport operator (MTO) responsible for any damage to the goods. Should goods be damaged while in transport by rail, the MTO may claim against the railway. It is therefore necessary that a suitable liability regime for railways be clearly established. In some countries railways have full liability, in others none and in yet others a very low limit of liability. Such disparities are not a very satisfactory for either shippers, or the MTO. It would seem appropriate if adequate limits of liability were introduced so as to ensure that the MTOs can obtain a realistic level of compensation for loss. In Europe, this has been achieved through the Convention concerning International Carriage by Rail (COTIF) and its Appendix B establishing Uniform Rules concerning the Contract for International Carriage of Goods by Rail (CIM). This Convention has so far been ratified by many European and some North African (Algeria, Tunisia) and Near Eastern countries (Iran, Islamic Republic of, Iraq, Lebanon, Syrian Arab Republic). According to the Convention, railway administrations are responsible for loss and

damages as well as for delay in delivery of cargo. Countries planning to establish container block train operations, should consider including in their legislation rules establishing adequate levels of liability for railways, or, in the case of international service, the conclusion of an intergovernmental agreement or adherence to COTIF.

Economic aspects

51. A thorough cost/benefit analysis should precede practical work on the establishment of new container block train services or the expansion of existing ones. One of the major elements to be taken into consideration is the availability of sufficient volume of container traffic to justify the required capital investments. For example, an ESCAP report[4] estimated that the transport of containers by block trains between Malaysia and Thailand would be profitable once the movement of goods reached 30,000 TEUs per annum in view of the number of improvements that the railways would have to carry out before it would be feasible to run regular block train services.

52. To secure economic viability of container block train services, the tariff level should be such that it attracts potential customers and then stimulates further expansion of the service while covering operational costs. Excessively high tariffs might discourage use and divert the container traffic to other modes of transportation, thus rendering futile the investments made in adaptating the railway line to container trains.

53. In the calculation of operational costs per TEU transported, the annual mileage of the rolling stock and the gross ton-kilometric performance of the service should be considered. Capacity of trains, type of rolling stock as well as operational modalities are functions of local economic decisions. Viability depends on the volume of container traffic and the balance between loaded and empty containers in both directions.

D. Influence on ports

54. The development of block train operations will have considerable impact on port competition patterns. If previously ports competed with nearby ports for traffic to the regional hinterland, with the introduction of container block train operations, the competition becomes inter-regional and intra-regional. Block train services make it economical to carry containers to a given inland point by a greatly increased number of different routes, thus bringing ports in different regions into fierce competition. In this respect a port can take an active role in promoting rail access and container transfer facilities in order to improve its position in relation to the development of block train operations and thus attract additional container traffic.

55. Ports may also co-operate with railways in the creation and promotion of new specialized rail services and in the upgrading of the existing services so that they correspond better to the needs of customers. Such co-operation may involve the sharing of investments and of the corresponding risks.

56. According to the rules published in 1988 in France the construction of railway sidings at ports has been financed jointly by the National Railways of France (SNCF) and the port in question investing a 50/50 share. In the United States and Canada, ports co-operate with railways in developing infrastructure and in adaptating it to permit the operation of double-stack container trains. For example, the port of San Francisco and the Southern Pacific Railroad (SP) have jointly resolved financial and engineering problems of adaptation of several tunnels to meet the requirements of double-stack container train operations. The port authority will contribute $11 million for this purpose.

57. As a recent example of the influence of railway services on competition between ports, the Canadian ports of Montreal and Halifax may also be cited. Canadian Pacific Rail (CP), through the acquisition of the network of the bankrupt Delaware and Hudson Railroad, is attracting North

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4 Major findings and recommendations for the development of rail container transport between Malaysia and Thailand, (ESCAP (TRANS/RGM (6) 7)), para 9

Atlantic container traffic to Montreal thus diverting it from the port of Halifax which had been serving this trade. At the same time CP has been increasing its penetration of the north-eastern container market in United States In order to attract additional ocean-borne container traffic at Philadelphia, situated at the southern end of the acquired network, a container rail terminal has been planned.[5] It is interesting to note in this respect that at the same time Canadian National Railroad (CN) froze its plan to start double-stack train operations from Halifax.[6]

58. For ports the importance of transport connections with the hinterland has been increasing constantly. Owing to rationalization of ocean services, introduction of the main port concept and upgrading of container ship dimensions, the cost of the maritime leg in the whole transport chain has been dropping. Consequently, the share of pre- and post-sea-leg transportation by inland means in the total cost of cargo transportation is rising. The competition between ports of the same region has become more fierce and is sometimes transformed into competition between the best inland transport servicing of ports. The role of railways in hinterland transport services since the introduction of containerization and container block trains has been increasing significantly because this mode of transport may best serve long-distance bulk transportation of containers.

59. The port authorities in developing countries should take carefully into account the importance of good transport connections with the hinterland. In order to improve their competitive position, they would need, in particular, to promote the development and upgrading of railway services.

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5 Lloyd's List, London, 26 October, 1990.

6 Lloyd's List, London, 2 November, 1990.

Chapter II

Land-bridge services

60. One of the important fields of application of container block trains is land-bridge services. By the term "land-bridge", the land portion of intermodal movements of cargo in containers between seaports is usually understood. There are several examples of land-bridges, the most important of which are the United States, Canadian and Trans-Siberian land-bridge services.

United States and Canadian land-bridges

61. The United States and Canadian land-bridges were established in the early 1960s to facilitate the movement of cargo by rail across the North American continent in trades between the Far East and Europe as an efficient alternative to all-water transportation. With the use of the land-bridge, transit time became 6 to 12 days shorter than all-water transport. One of distinguishing features was the use of a single transport document for the entire movement of containers between Europe and the Far East, issued by shipping companies or non-vessel operating multimodal transport operators (NVO-MTO).

62. Besides land-bridge, in the practice of the multimodal movement of goods in the United States, the terms "minibridge" and "microbridge" are used to describe the land portion of transportation between seaports on United States coasts and inland points and *vice versa*. Minibridge systems link the Far East and European ports with the points inside the United States via west coast, east coast and Gulf of Mexico ports. Microbridge systems were devised in the late 1960s and early 1970s to apply directly to haulage between interior points in the United States and Canada and ports in other parts of the world via a single port, avoiding double port rates and transit involved in minibridge systems. Minibridge and microbridge tariffs are published by steamship lines and the proportional divisions of revenues are negotiated by these lines with participating railways.

63. These services are in general advantageous for shippers. They thereby benefit from single intermodal tariffs. Instead of making separate arrangements for transportation of their cargo from inland origin to export gateway port, then from this port to a foreign port and then again for inland transport to the point of destination, shippers may deal with one single transport organization (shipping line or NVO-MTO). This approach relieves them of having to make numerous arrangements. The introduction of land-bridge/minibridge/microbridge services in the United States and Canada together with deregulatory governmental measures has had considerable impact on the pattern of competition between the different carriers; it has diverted cargo from shipping lines using all-water routes, prompting them to introduce their own multimodal tariffs. For example, a large part of the failure of US Lines' round-the-world operation was attributed to competition from faster and somewhat more cost-effective land-bridge services. Equally significant was the steady drop in traffic carried by certain lines serving the United States east coast via the Panama canal.[7]

64. There are about 50 steamship lines operating land-bridge/minibridge/microbridge services in the United States and Canada, and as much as 50 per cent of ocean-borne traffic from the Pacific new industrialized countries to the United States reaches its final destination by rail intermodal land-bridge services. The United States Pacific coast ports have greatly benefited from land-bridge services at the expence of the east coast and Gulf of Mexico coast ports. The big winners were the ports of Los Angeles and Long Beach from which more than 50 per cent of cargo entering has as its destination inland United States points. San Francisco and Oakland, although showing increased tonnage, have lost relative market share because of limited railway tunnel clearances on their main east-west routes which place height limitations on double-stack container trains. In 1980 their combined throughput, which totalled 869,675 TEUs, accounted for 29 per cent of all

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7 Gerhardt Muller, *Intermodal Freight Transportation*, Second Edition, ENO Foundation for Transportation, Inc., Westport, Connecticut, 1989, p. 75.

United States Pacific coast container movements. In 1989 this had declined to 17.2 per cent. Conversely, the ports of Long Beach and Los Angeles have increased their market share substantially, up from 38.2 per cent in 1980 to 51.8 per cent in 1989.

65. Significant efforts have been made jointly by railways, ports and local authorities to upgrade port facilities and eliminate these restrictions, allowing unrestricted double-stack container train operations. Chapter III offers more information on the operation of the United States land-bridge services using double-stack container block train technology.

Trans-Siberian land-bridge

66. The Trans-Siberian landbridge provides overland intermodal service between the Far East and Europe through the the Union of Soviet Socialist Republics. This is the longest of all land-bridges now in operation; however the itinerary using this land-bridge is much shorter than the all-water route: 13,000 km *versus* 21,000 km for the shortest route through the Suez canal. The first trial carriage of transit containers by the Soviet railways on this land-bridge was initiated by a Japanese freight forwarder in 1965. Regular services, known as the Trans-Siberian Container Line (TSCL), were inaugurated in 1971. At present the TSCL is operated by the various European and Japanese NVO-MTOs (24 in total), with the Soviet organizations acting as sub-operators.

67. The service comprises a complex system of land and ocean transportation. It involves three steamship lines (two Japanese and one Soviet) serving two transshipment ports: Vostochnyy and Nakhodka. From there, containers are carried by container block trains of the Soviet railways. At the western end of the land-bridge, containers must be again transshipped because of the difference in track gauge between the Soviet and other European railways (except for the Finnish railways which have the same gauge: containers are transported from Lujaika at the Soviet border to the Finnish port of Kotka from where they are carried by sea to western European countries). The main land transshipment points on the western Soviet border are Brest (boarding Poland), Chop (Czechoslovakia and Hungarian borders), Ungeny (Romanian border), at the southern border, Dzhulfa and Astara (Iranian border) and at Termez and Kushka (Afghan border). Through the western European railway network, containers are transported by ***Intercontainer*** trains (Transrail service). Since January 1991 the German railways' subsidiary ***Transfracht*** also operates daily container block trains from Berlin and Cottbus to Brest (USSR). Owing to the railway gauge difference, however, most containers complete the final leg by road transport (Tracons service). A large truck terminal has been set up at Brest and a complete door-step service is provided for direct delivery to consignees.

68. Containers coming to a Soviet port (Leningrad, Riga, Tallin or Odessa) are transported by sea to a western European port by one of the Soviet shipping lines (Trans-Sea service). Since 1987 the service Trans-Sea has been concentrated on Riga and Tallin.

69. The Japan - Europe transit time is targeted at 25 - 28 days for Tracons service, 25 - 30 days for Transrail and 30 - 35 days for Trans-Sea. In 1987-1988, the real transit time for the rail portion between Vostochnyy and Riga was 16 days (54 per cent), 17 days (27 per cent), 18 days (15 per cent), 20 days and more (4 per cent).[8]

70. Containers are carried on block trains only in the westerly direction owing to the imbalance of traffic (about 50 per cent). Container block trains are composed of 50 to 54 specialized flats with a train capacity of 108 - 116 TEUs. Until recently, block trains did not depart until they were fully loaded; later a minimum volume for departure was set at half load. This has reduced the waiting time and made it possible to respect a fixed schedule of the service connected with the arrivals of container ships (system "boat - train"). About 45 block trains a month are operated for all destinations of the land-bridge.

71. There is a significant imbalance in the volume of container traffic and in the share of 20- and 40-foot containers by direction of flow. In 1989, the share of 40-foot containers carried in western direction to the port of Riga was 64 per cent, while that to the port of Tallin was about 70 per cent. In an easterly direction, the major volume of container traffic is 20-foot containers. This imbalance in container movement poses problems for organizing container block train operations and in the

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8 Morskoy Flot, Moscow, November 1990, p. 9.

re-positioning of empty containers.

72. Despite the geographically advantageous situation of the Trans-Siberian land-bridge and its potential to save time, it currently carries no more than 3 per cent of the total container traffic in the trade between the Far East and Europe. The volume of container traffic peaked in 1983 at 127,305 TEUs in both directions, but in 1988 it had dropped to only 81,700 TEUs. The service has been facing fierce competition from conference and non-conference shipping lines on the Far East - Europe route. Shipping lines on this route are introducing increasingly larger container vessels and have offered lower freight rates than those of the TSCL. As a result, some clients have switched to the all-water route. At the same time cargo flows to Iran, Islamic Republic of, and Afghanistan have declined. Another reason discouraging shippers from using this service was that the targeted transit time was not always respected. The absence of a single Soviet operator who could issue his own door-to-door multimodal transport documents and take responsibility for the cargo along its whole itinerary may also be a handicap for the land-bridge.

73. Measures are currently being taken to improve the situation and to upgrade the level of service. At the beginning of 1990, a new organization, the Association of Soviet Railways was created to involve the Soviet Railways directly in the marketing of the services through joint ventures with foreign customers of the TSCL. The upgrading of container block train operations with a guaranteed transit time, development of container tracking systems and improvements in marketing and management practices are some of the main activities directed at attracting potential new customers to this transcontinental land-bridge service.

Other land-bridge services

74. A land-bridge was established in Mexico in 1982 between the Pacific port of Salina Cruz and the Gulf of Mexico port of Coatzacoalcos (distance about 300 km). Transit time across this land-bridge by rail is 12 hours; under normal operational conditions, a significant time saving can be gained in comparison with transit via the Panama canal. However, so far the results of its operation have been rather disappointing, despite substantial investments in handling and transport facilities at both ports and in the railway for container operations.

75. A feasibility study has been initiated in Thailand for a modern 180-kilometre long land-bridge infrastructure linking the Indian Ocean coast of the country to the Gulf of Thailand. Besides the inland transportation components, the project will include two seaports and other related facilities. The land-bridge will shorten the distance for cargo flows from the Middle East and Europe to the Far East by 2,750 kilometres.

76. Quite recently a plan has been announced for the establishment of multimodal transport land-bridge services through South America. It will connect Argentina, Paraguay and Uruguay via Bolivia and Chile.[9] . The Governments of these countries have signed an agreement to start work, each in its own country, on this project. The land-bridge will have a total length of 10,500 kilometres primarily using existing railway lines. It would serve as an alternative to coast-to-coast maritime transportation of cargo through the Straits of Magellan. At present, the railways which will form the future land-bridge are in poor technical condition. Some have a different track gauge which will necessitate their renovation or reconstruction. The projected service will be operated by a joint company founded for this purpose.

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9 *Journal of Commerce*, New York, 26 December, 1990.

Chapter III

Experience of Container Block Train Operations

A. United States of America

77. The most sophisticated system of container block train services has been developed in the United States where the innovative technology of double-stack container trains was designed and introduced.

78. The first double-stack block train container services were started by shipping companies between the west coast of the United States and interior points. As of mid-1989, over 100 trains departed from the west coast each week with double-stack traffic, including single-customer unit trains, regularly scheduled "common user" trains serving multiple customers, combined double-stack and conventional wagon trains and blocks of double-stack wagons included in conventional block trains.

79. Double-stack wagons use a well platform to allow the containers to be stacked two high. These platforms are articulated in sets of five, adjacent platforms being supported by one shared bogie assembly. Articulated wagons provide better riding quality and consequently decrease the risk of cargo damage. Double-stack wagons have a higher net weight-to-tare ratio than other rolling stock and, therefore, require less power and fuel to move the same amount of cargo. Net payload to tare ratio for double-stack wagons can attain 1.97 versus 1.52 for light-weight articulated-spine wagons and 1.38 for conventional container wagons. These wagons have lower aerodynamic resistance, thus further reducing fuel consumption. For a given train length the double-stack wagons allow the carriage of twice the number of containers, thereby reducing the operating costs including the labour cost which is a major expense on the United States railways, amounting to 60 per cent of line-haul costs. Depending on distance of carriage and other variables, the total savings from the use of double-stack wagons may be 20 to 40 per cent in comparison with other intermodal equipment.

80. Though double-stack trains can attain speeds of 125 km/h on good tracks, they average 65 km/h on the line service, owing to stops and crew changes. Double-stack systems do not offer significantly lower terminal and overhead costs than other intermodal systems. They may have even higher terminal costs. In general, the costs of loading and unloading double-stacked containers is comparable to that of other equipment types.

81. Container rail traffic is concentrated on relatively few major routes connecting major container ports with major inland intermodal hubs. Rail container traffic is overwhelmingly international. According to estimates, domestic container movements accounted for about 5 to 7 per cent in 1988 and about 9 per cent in 1989 of all rail container traffic. A study sponsored under the United States Department of Transportation by the Federal Railroad Administration and the Maritime Administration[10], lists the major flows of international rail container traffic given in 40-foot-equivalent units (FEUs). (See table 2).

82. According to the same study, a double-stack route must have enough volume to run a six-day-per-week service at major hubs and a five-day-per-week service at intermediate points and have long hauls of 725 miles (1,200 km) or more in order to be competitive with road transport in the carriage of containers. Even in the domestic long-haul high-volume markets, double-stack technology is seen as progressivly dominating over the more traditional piggy-back trailer-on-flat-car (TOFC) technology.

83. In addition to many mainline north-south and west-east corridors in North America, double-stack trains are being introduced to an ever-increasing extent on smaller branch lines. The Association of American Railroads was reported an increase of over 10 per cent in double-stack traffic for 1990, while piggy-back or TOFC service had a slight drop of 0.7 per cent. The main

[10] Executive Summary of the Report: Double Stack Container Systems: Implications for U.S. Railroads and Ports, U.S. Department of Transportation, Washington, D.C., June 1990.

Table 2

Major flows of international rail container traffic in the United States

Corridor	Import FEUs	Weekly train equivalents	Export FEUs	Weekly train equivalents
Northeast				
Atlantic	571,910	57.2	86,542	8.7
Great Lakes	275	0.0	26	0.0
Gulf of Mexico	30,969	3.1	4,193	0.4
Pacific	294,413	29.4	9,936	1.0
Subtotal	*897,567*	*89.8*	*100,697*	*10.1*
Northwest				
Atlantic	4994	0.5	1,180	0.1
Great Lakes	4	0.0	35	0.0
Gulf of Mexico	801	0.1	519	0.1
Pacific	34,594	3.5	116,182	11.6
Subtotal	*40,393*	*4.0*	*117,916*	*11.8*
Southeast				
Atlantic	89,750	9.0	103,014	10.3
Great Lakes	17	0.0	17	0.0
Gulf of Mexico	43,133	4.3	44,156	4.4
Pacific	24,308	2.4	15,564	1.6
Subtotal	*157,208*	*15.7*	*162,751*	*16.3*
Upper Midwest				
Atlantic	87,355	8.7	34,095	3.4
Great Lakes	885	0.1	1,735	0.2
Gulf of Mexico	9,815	1.0	4,991	0.5
Pacific	153,375	15.3	37,972	3.8
Subtotal	*251,430*	*25.1*	*78,793*	*7.9*
Total	*1,969,916*	*197.0*	*949,406*	*94.9*

Source: Executive Summary of the Report: Double Stack Container Systems: Implications for U.S. Railroads and Ports, U.S. Department of Transportation, Washington, D.C., June 1990.

reason for the increase was the strong growth in domestic container traffic. The double-stack wagon fleet used by railways and other operators grew in 1990 by 4,200 new units and comprised 20,000 wagons. It was expected that another 3,000 to 4,000 wagons would be ordered in 1991.

84. In providing double-stack container rail services in the United States, not only railways but other parties are also involved. Their respective participation in the different constituent parts of this service - such as mainline service, equipment provision, terminal operations, origin and destination drayage and marketing - changes, depending on the specific cases. They include ocean carriers, NVO-MTO, agents, equipment lessors.

85. At present only line service operations remain the exclusive activity of railways. As regards double-stack rolling stock, the major American railways have established a specialized company, ***TrailerTrain***, which acquires, manages and maintains a national pool of wagons for use. The provision of intermodal equipment, such as wagons and containers, has increasingly become the activity of ocean carriers which have become major players in domestic third-party marketing schemes. Even locomotives are commonly leased or provided on "power by the hour" or "power by the mile" arrangements. Railways own most inland terminals, but many of them are operated under contract by subsidiaries or independent firms. Some ocean carriers, major shippers or third parties have or operate their own terminals. Drayage is most often performed by local companies, although in some cases it is provided by railways or intermodal subsidiaries of ocean carriers.

86. In the use of double-stack container train operations responsibility for organizing complete door-to-door service for the customer is borne by a third party such as the affiliates of ocean carriers, non-vessel operating common carriers (NVOCCs), freight forwarders, and shippers' agents using as the key instrument of organization a contract covering rail services and rates, equipment

supply, terminal and drayage operations.

B. Australia

87. Owing to its historical background and physical conditions (vast, sparsely populated areas, long distances between cities, different track gauges) the railway system in Australia has certain features similar to railways in developing countries. The standard-gauge railway network joining all the individual state capitals and the main commercial centres was completed only in the 1980s. As a result, rail freight operations, as a commercially competitive transport option, have only recently emerged with modern equipment, rolling stock and methods of operation now rapidly expanding.

88. Between 90 and 95 per cent of Australia's inland transport of maritime container traffic is carried by railways. Some shipping lines deal directly with the railways to move containers by block trains. One example is a joint venture between P&O Cl. with Australian National Railway (AN) that consolidates container traffic on behalf of the shipping industry and operates container block trains. Similarly, some major Australian freight forwarders have recently begun to contract their own container block trains from the railways on a long-term basis in order to move domestic and international cargo with pick-up and delivery service at both ends.

89. Victoria Line in co-operation with other Australian railways, State Rail Authority of New South Wales (State Rail) and Western Australian Government Railways (Westrail) in particular, operates a system of "Superfreighter" and "Westliner" container block trains between Melbourne and all other mainland state capitals of Australia. These cities are also its main ports. The trains run on fixed schedules.

90. The specialized high-speed container rolling stock used for these trains permits loads of 2, 3 or 4 TEUs per wagon, with loads up to 57 tons. Containers as high as 9 feet 6 inches can be transported. In general the rate of utilization of train capacity is about 90 per cent. The total volume of maritime container traffic handled by "Superfreighter" trains in 1989/1990 was 50,571 TEUs of which 33,804 were between Melbourne and Adelaide in both directions. Recently a new type of rolling stock, the five-pack wagon, has been introduced, permitting the carriage of ISO containers in double stacks. Table 3 gives details of "Superfreighter" and "Westliner" container block trains.

91. Beside the system of "Superfreighter" trains, Victoria Line operates land-bridge trains for the shipping industry between Melbourne and Adelaide. The concept of this operation is based on the use of blocks of wagons loaded with containers at several port sidings and marshalled into a train. The movement of these container block trains is always subject to arrivals/sailings of container ships.

92. State Rail also operates the "Liner Trains", run on an "as required" basis for the positioning of import/export containers between ports and container parks (Sydney - Brisbane and *vice versa*). State Rail is planning to introduce a weekly return block container train between Sydney and Perth. Victoria Line expects to increase the number of "Superfreighter" block trains in each of the corridors served.

93. Queensland Railways also operate five container block trains. One of them, running between Fisherman's Island and Murarrie (14.4 kilometres, transit time 25 minutes) runs daily (Monday to Friday) and transports on 20 wagons 18 x 20-foot and 2 x 40-foot containers. This service is of an auxiliary nature and connects the container terminal at Fisherman's Island with the container park at Murarrie. It is in fact an extention of that container terminal and used for long-term storage and servicing of containers.[11] Two other container block trains to Brisbane from Goondiwindi (456 km) and from Yamala (880 km), transporting cotton seed and cotton lint, operate only during the harvest season. They have a capacity of 58 and 42 TEU's. The block trains to Brisbane from

[11] The operation of the Murarrie container park with low cost dwelling time of containers enables the port terminal operator to reduce container dwell time at the port container terminal at Fisherman's Island thus increasing the efficiency of the operation of the latter. The shuttle train service between these two facilities is operated at competitive freight rates in comparison with road transport and, moreover, avoids possible additional costs due to delays connected with truck queing at the terminal gates.

Table 3

Routes of "Superfreighter" and "Westliner" container block trains

Itinerary	Distance km	Transit time hours	Trains per week	Composition of train	
				wagons	TEUs
Melburne - Adelaide	776	14.5	6	28	90
Adelaide - Melburne	776	14.3	6	28	90
Melburne - Adelaide	776	14.5	5	28	90
Adelaide - Melburne	776	15.2	5	28	90
Melburne - Brisbane	1,923	37.2	6	26	84
Brisbane - Melburne	1,923	38.7	6	26	84
Melburne - Sydney	961	14.0	5	26	84
Sydney - Melburne	961	13.3	5	26	84
Melburne - Perth	3,437	56.0	5	28	90
Sydney - Brisbane	980	20.0	5	31	100
Brisbane - Sydney	980	20.0	5	31	100
Sydney - Adelaide	1,670	31.0	6	23	84
Adelaide - Sydney	1,670	31.0	6	23	84

Source: Replies to the UNCTAD secretariat questionnaire.

Moranbah (1,078 km) and from Boonal (818 km), carrying ammonium nitrate in containers, operate on an "as required" basis. Each of them has a capacity of 30 TEU.

94. Recently a decision was taken by the Government of Australia to establish a single body responsible for the transportation of goods by railways throughout the country: ***National Rail Freight Corporation*** which was expected to be operational by the middle of 1991. The corporation will operate on a commercial basis and its operational activities will no longer be hampered by different rules and regulations imposed by the various railway operators.

C. Japan

95. Rail freight transport in Japan has only a 5 per cent share of the total volume of domestic cargo transport. When the Japanese national railways in 1987 were privatized and divided into six private railway companies, the Japan Railway Freight Company (JR Freight Company) was created as the only nationwide railway freight business using the infrastructure of these railways. The company operates only container block trains and block trains for bulk cargoes such as petroleum and cement, all non-stop. The JR Freight Company operates 302 container block trains in domestic service with a total about 7,100 container platforms and 69,000 containers (mostly 8-foot-wide and high and 12-foot-long standard rail containers). The average distance of container transportation is about 920 kilometres. One of the features of the company's activity is close coordination with forwarders and adaptation to the customers requirements for more frequent transport and just-in-time delivery.

96. The domestic transport of maritime containers by train operated between 1976 and 1986 was finally abandoned because of the inefficiency of the one-trip-a-week operation. There have been some plans to revive this kind of traffic in the light of new developments.

D. Europe

97. European railways have been collaborating to expand the network of cross-border through-trains directly connecting key centres. Although the railways do not intend to abandon less-than-trainload traffic, the principal activities of such international rail operating organizations as ***Intercontainer*** and International Association of Piggyback Companies (UIRR) concentrate on the promotion of block trains on the principal axes.

Intercontainer

98. In 1967 the national railway administrations of 24 European countries created the International Company for Transport by Containers: ***Intercontainer***. The task of this organization has been to market international container transportation by grouping consignments so as to form large-volume regular traffic flows. Individual railways can then reduce their unit costs of container transportation. The price advantage is passed on by ***Intercontainer*** to its customers in proportion to the scale and regularity of their traffic. In rendering its services, ***Intercontainer*** operates specialized container trains or Trans-Europe-Container-Express (TECE) and company trains for individual customers.

99. TECE trains operate along routes with a regular large-scale volume of traffic. They form a basic network of special-purpose container trains, connecting important European ports and industrial centres. To preclude delays at borders and accelerate deliveries, customs clearance as well as specialized ***Intercontainer*** road services linked with these trains are provided at terminals. Routes, frequency of operation and transit time of TECE are given in table 4.

Table 4

Destinations, frequency and transit time of TECE

Route in both directions	Trains per week	Terminals served	Transit time hours
Rotterdam - Basle - Milan	5	Rotterdam, Basle, Milan	36
Zeebrugge/Antwerp - Basle (only north - south)	5	Zeebrugge, Antwerp, Basle	18
Antwerp - Turin/ Novara/Milan	5	Antwerp, Turin, Novara, Milan	36
Dunkirk - Turin/Milan	5	Dunkirk, Novara, Turin, Milan, Melzo	36
Amsterdam/Rotterdam - Antwerp/Zeebrugge	10	Amsterdam/Rotterdam Antwerp/Zeebrugge	4
Paris - Turin/Novara/ Milan	5	Paris, Turin, Novara, Milan	24
Hamburg - Copenhagen	5	Hamburg, Copenhagen	18
Hamburg - Arhus	5	Hamburg, Arhus	12
Gothenburg - Oslo	5	Gothenburg, Oslo	12
Antwerp/Bressoux - Milan	4	Antwerp, Bressoux, Luino, Milan, Melzo	34
Zeebrugge- Milan	6	Zeebrugge, Novara, Milan, Melzo	36
Neu Ulm - Salonika/Athens	2	Paris, Rotterdam, Antwerp Karlsruhe, Hamburg, Achen Munchen, Frankfort, Cologne Dusseldorf, Mannheim, Neu Ulm, Salzburg, Salonica, Volos, Athens	78
Dusseldorf - Port Bou	2	Wuppertal, Cologne, Perpignan	38
Milan/Melzo - Madrid - Barcelona - Valencia	2	Milan, Melzo, (Port-Bou, Cerbère, Modane, Bardoneccia), Barcelona Valencia, Madrid	44

Source: Jane's Freight Containers. An international survey of container and roll-on roll-off operations, London, 1987, p. 676 and various news reports.

100. Transportation of maritime containers from and to sea ports is the largest market of ***Intercontainer***. In 1989, this traffic totalled 611,050 TEUs (of the total container traffic equal to 1,120,929 TEUs or 54.5 per cent), an overall increase of 23.7 per cent by comparison with 1988.

This traffic meets fierce competition from feeder shipping, inland waterways and the major shipping companies which, in their rationalization efforts, provide their own transportation of containers from port to hinterland.

101. Trains for individual customers operate on different routes under conditions similar to TECE trains. As an example of such service, Olofström - Ghent block container train operated by ***Intercontainer*** for Volvo can be cited. Four and, exceptionally five, 25-wagon block trains run weekly carrying 50 20-foot containers each. A total of 1,400 containers are constantly moving back and forth between these two points, ensuring a fully integrated transport just-in-time, door-to-door service for the Ghent Volvo factory. From Helsingborg to Copenhagen and then from Rødbyhavn to Puttgarden the trains are carried by ferries. The whole journey takes three and a half days.

102. By the end of 1989, ***Intercontainer*** was operating its own 3,876-strong fleet of wagons as well as leased wagons belonging to railways. That year 44.6 per cent of the company's traffic was transported by its own fleet. ***Intercontainer*** had ordered a total of 260 wagons with interchangeable axles, of which 158 were in circulation by the end of 1989. There is a container pool commonly established by the members of the organization. It consists of primarily 2.5 metre-wide railway containers adapted to pallets and used only for intra-European traffic.

103. The construction of the Channel tunnel between Folkestone (United Kingdom) and Calais (France) will create a permanent rail link between the railway systems of the United Kingdom and Europe which will be used by direct high-speed container block trains connecting main Continental and British centres. After 1993 some 12 daily trains will handle up to 250,000 TEU per year. To overcome the principal operational difficulty for container carriage by these trains - the limited loading gauge on British Rail - specialized rolling stock will be used. At present the most satisfactory solution proposed is the French ***Multifret*** low-floor-level wagon, permitting the carrying of up to 2.75 metre high containers on British Rail. This wagon fleet will be operated by ***Intercontainer***.

Transfracht

104. Many European railways have their subsidiary organizations dealing with domestic transport of containers by rail such as ***Transfracht*** which operates container block trains on the railways in the Federal Republic of Germany and ***Compagnie nouvelle de conteneurs***, a specialized company for container and swap-body transport of the French national railways.

105. In relation to the pricing of the traffic of maritime containers between the sea ports and inland points in Germany through the ports of the Hamburg - Antwerp range (Hamburg, Bremen, Bremerhafen, Rotterdam, Antwerpen, Lübeck, Kiel, Nordenham, Brake, Amsterdam, Vissingen and Zeebrügge), ***Transfracht*** has set up the Maritime Container Network (MCN). For the purpose of this system, the whole territory of Germany has been split into 145 grids. Each grid constitutes a tariff zone within which equal prices are being charged for transport of loaded or empty containers to and from the sea ports. Tariffs are no longer set on a rigid principle of tariffication according to distance in kilometrs but are flexible and based on the prevailing competitive situation. Under this system, a complete hinterland transport service for return or triangular transport of maritime containers by block trains is provided.

Poland

106. Container block train services are as yet under development in Poland. Although there are several fixed routes for multimodal transport with a fixed schedule, they are not fully used owing to lack of containerized cargo. Table 5 gives the details of these routes.

Table 5

Container block train routes in Poland

Origin - Destination	Distance km	Transit time hours	Frequency
Zebrzydovice - Swinoujsce	667	18	1 - 2 a week
Zebrzydovice - Gdynia	625	15	weekly
Zebrzydovice - Malaszewicze	519	15	1 - 2 a week
Rzepin - Malaszewicze	644	14	daily

Source: Replies to the UNCTAD secretariat questionnaire.

107. The service Zebrzydovice - Gdynia (Poland) is co-ordinated with ***Polfin*** Ro-Ro line, Helsinki (Finland); the other services are on a fixed schedule. Block trains consist of 20 to 25 special container wagons with a total capacity of 60 to 75 TEU. The maximum height of containers which can be transported in Poland is 8 feet 6 inches.

Czechoslovakia

108. There are several routes served by container block trains in Czechoslovakia. None of them is linked with container ship operations, though some could be considered as the extension of the Trans-Siberian land-bridge. Container block trains are operated by the Czechoslovak combined transport operator ***Intrans***. Specialized container rolling stock is used in block trains. For transportation of larger than ISO standard containers an agreement of the Czechoslovak State Railways is necessary. Approximately 54,000 TEU had been carried by container block trains in 1989/1990. Table 6 gives the details of these routes.

Table 6

Container block train routes in Czechoslovakia

Origin - Destination	Distance km	Transit time hours	Frequency	Composition of trains	
				wagons	TEU
Prague - Brno	254	6 h 30 min	daily	13	80
Prague - Valasské Mezirici	332	11 h 15 min	daily	18	70
Bratislava - Chosen	266	9 h	daily	4	26
Cierna-nad-Tisou - Chosen	642	20 h 35 min	daily	26	100
Cierna-nad-Tisou - Bratislava (via Galanta)	528	24 h 30 min	daily	20	50
Cierna-nad-Tisou - Bratislava (via Stúrovo)	584	31 h	daily	20	50
Bratislava - Zilina	201	11 h	daily	20	90
Beroun - Prague	49	1 h 30 min	twice a day	6	50
Lhotka-nad-Bechvou - Matovce	468	13 h	daily	46	100

Note: Table gives the average number of wagons per train in 1989 and the maximum capacity of train in TEUs.
Source: Replies to the UNCTAD secretariat questionnaire.

E. Container block train operations in developing countries

109. The introduction of container block train services has so far been possible only on a limited scale and in relatively few developing countries. In almost all cases, such trains are operated by the national railways on a port-to-interior basis, although there are a few land-bridge services in

existence. In even fewer cases, container block trains are operated by or for large-scale (mega) MTOs from developed countries.

India

110. The creation of a network of inland clearance depots (ICD) linked by railway lines has largely contributed to the development of container transportation by block trains. The Indian Government has set a target of 23 ICDs of which 11 are already in operation. About 90 per cent of containers carried by Indian railways are moved by block trains. During 1989-1990, a total of 49,580 TEUs were carried. The figure for 1990-1991 is expected about 63,000 TEUs. Table 7 gives details of the special-purpose container block train operations by Indian railways.

Table 7

Container block train routes in India

Origin - Destination	Distance	Transit time	Weekly	Capacity of trains	
	km	hours	frequency	wagons	TEUs
Bombay - New Delhi	1,385	70	4 each way	35	70
Jawaharlal Nehru - New Dehli	1,448	70	1 each way	40	80
Haldia - Guvahati	1,163	75	2 each way	40	80
Madras - New Delhi	2,194	120	1 each way	40	80
Madras - Anaparti	612	24	unscheduled	35	70
Madras - Guntur	453	24	unscheduled	35	70
Madras - Bangalore	364	24	2 each way	22	44

Source: Replies to the UNCTAD secretariat questionnaire.

111. Operation of container block trains between Madras and New Delhi as well as between Jawaharlal Nehru Port and New Delhi is co-ordinated with container ship arrivals/sailings on a scheduled basis. Specialized bogie flat wagons carrying two 20-foot containers or one 40-foot container are used in container block trains. Only ISO standard 20- and 40-foot up to 8-foot-6-inch high containers can be transported by Indian railways.

112. Certain foreign carriers are using special-purpose block trains; one of them, Company Maritime Belge (CMB) operates eight trains a week from Bombay to Delhi. American President Lines (APL) inaugurated its weekly container service between Madras and Dehli in March 1991.

Pakistan

113. Pakistani Railways operate special-purpose container block train service with a capacity of 70 TEUs and a frequency of about 1.7 train per week in each direction on the 1,220-kilometre corridor between the port of Karachi and the Lahore dry port. Separate container block trains offering weekly service are operated by the railways on contract with APL, which has its own container freight station in Lahore. Another major United States operator, Sea-Land, has been examining the possibility of establishing container block train services on the same corridor in 1991.

Thailand

114. Container block trains are operated between Bangkok (Bang Sue) and Sattahip Commercial Port (SCP). The distance is 199 kilometres and the transit time is five hours. The frequency is three round trip per day (six trains), four days a week on a fixed schedule. Each container block train consist of 30 wagons with an average capacity of 60 TEUs. A special bogie flat-platform container wagon which can carry two 20-foot or one 40-foot container is used as standard rolling stock for container block trains. The number of platforms carrying 45-foot containers is limited.

115. During the fiscal year of 1989 (October 1988 - September 1989) the Thai National Railways carried 25,142 TEUs; for 1990 (October 1989 - September 1990) the volume was 49,366 TEUs. This sharp increase has primarily been attributed to the redirection of the APL's ships calls to Sattahip and to the contracting by this carrier with the railways for the carriage of containers between Sattahip and Bangkok. In view of the operation of the new deep sea port Laem Chabang, the number of container block trains and the volume of container traffic are expected to increase significantly.

Malaysia

116. Peninsular Malaysian Railways moved 87,383 TEUs in 1989 and 93,313 TEUs in 1990 (mostly between Port Klang and Butterworth (Penang)). About 75 per cent of this traffic was carried by container block trains. There are six daily trains and a number of weekly or other frequency services. Serious efforts have been made to upgrade the quality of container block train services. By March 1991, some 300 new bogie container wagons will have been put into service with an axle load of 16 tons (in comparison with the 14-ton axle-loads of the existing fleet). The speed of the block trains will be increased from 55 to 75 km/h.

Kenya

117. Kenya Railways operate daily container block trains from Mombasa (Kilindini) to the ICD at Embakasi (Nairobi). These trains are known as "Railtainers". There are two daily "Railtainer" services from Mombasa to Embakasi and one service from Embakasi to Mombasa, a distance of about 520 kilometres. The "Railtainer" service runs daily on fixed schedules without strict co-ordination with containerships arrivals/sailings. Transit time does not exceed 15 hours.

118. There are also mixed trains every other day between the following points:

- Nairobi - Kisumu (398 km);
- Nairobi - Nakuru (181 km);
- Nairobi - Eldoret (385 km);
- Nairobi - Malaba (552 km) and
- Thika - Mombasa (577 km).

119. Of these services the first four may be considered as extensions of the "Railtainer" services between Mombasa and Embakasi. For the other destinations, it is stated that transit time for any container service system-wide does not exceed 36 hours from point of departure to destination station. The longest distance (from Mombasa to Malaba at the Uganda border) is 1,082 kilometres.

120. For carrying containers, Kenya Railways use both conventional rolling stock and special container platforms fitted with twist locks. There are plans to acquire more container platforms, subject to the availability of funds. The composition of "Railtainer" trains is a maximum up to 25 platforms and overall capacity of 50 TEUs. A block train between Nairobi and Nakuru/Eldoret/Malaba can move a maximum of 20 wagons (40 TEUs). A block train between Nakuru and Kisumu has a capacity of 15 wagons and 30 TEUs. In spite of restrictions imposed by the infrastructure, 9-foot-6-inch-high containers are admitted. The volume of rail container traffic in 1989 was about 35,476 TEU. Container block trains between Mombasa and Embakasi moved 29,563 TEU of this volume.

Nigeria

121. The beginning of transportation of containers by the Nigerian Railways goes back to the mid-1980s. The main routes are from Apapa Wharf to Kaduna Junction (909 kilometres) and to Kano (1,132 kilometres). The main customers supporting this traffic are Peugeout Nigeria and Inland Containers Nigeria. Containers are transported by unscheduled block trains, the operation of which depends on the availability of containers in the ports or of empty containers at the cus-

tomers' premises. The frequency is one to two trains weekly for the hinterland destination and one train weekly for the port destination. Trains with empty containers are combined to form a "jumbo" train moved by several locomotives. The transit times on these two routes are 36 to 48 hours and 72 to 96 hours, respectively. This is conditioned by technical restrictions and by the operational situation on the line.

122. The condition of locomotives do not permit train loads of more than 38 loaded TEUs, although initially the trains were designed to carry 50 loaded TEUs or 98 empties. The trains are composed of specialized flats with twistlocks each carrying two 20-foot containers. Only 20-foot containers can be carried by these trains.

Other container block train services

123. The UNCTAD annual *Review of Maritime Transport*, based on various sources, regularly reports on the development of container block train services, in particular in developing countries.

124. According to these reports, container block train services operate in the Republic of Korea (four trains daily between Seoul and Busan in both directions) and in Saudi Arabia (two trains daily except Thursday and Friday between Damman and Riyadh in both directions). On a more limited scale, container block train operations exist in Indonesia (two trains a week), in Sri Lanka (one train a week) and in Tanzania, where an international service has been established between Dar-es-Salaam and Mwanza/Jinja (Uganda) through Kigoma.

125. Further expansion of multimodal services and containerization in developing countries and establishment of networks of ICDs connected by railway lines may require the introduction of new container block train services. In their decisions regarding the technical aspects and investments necessary for the establishment of the future services, governments and other decision-making parties may find the accumulated experience in this field helpful, especially the experience of those developing countries which have already established such services. The Group of Experts may wish to request the secretariat to monitor developments in this field and to report regularly to the Committee on Shipping. The Group may also wish to request the secretariat to study on the specific problems which render difficult the introduction of container block trains in developing countries.

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